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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/813,240	03/20/2001	Wilfried Von Ammon	VON AMMON ET AL 9	1729

7590 06/26/2002
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EXAMINER

MONDT, JOHANNES P

ART UNIT PAPER NUMBER

2826

DATE MAILED: 06/26/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/813,240

Applicant(s)

AMMON ET AL.

Examiner

Johannes P Mondt

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 April 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2 and 4-6 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2 and 4-6 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Amendment A filed 4/16/02 has been entered as Paper No. 6 and has been considered prior to this Office Action. Please be referred to "Response to Arguments" below for comments on Applicant's "Remarks".

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. **Claims 2 and 5** are rejected under 35 U.S.C. 103(a) as being unpatentable over Tamatsuka et al (6,291,874) in view of Kuhn-Kuhnenfeldt et al (4,330,361). Tamatsuka et al teach a method for producing a silicon semiconductor wafer comprising:

pulling a silicon single crystal from a melt in the presence of hydrogen (cf. column 6, lines 47-51) using the Czochralski method (cf. title, abstract, column 1, lines 58-63, and column 2, lines 19-38);

doping the silicon single crystal with nitrogen and producing a nitrogen concentration of 5×10^{12} to 5×10^{15} atoms cm^{-3} ; and

separating the silicon semiconductor wafer from the silicon single crystal (cf. abstract).

Tamatsuka et al do not necessarily teach the single crystal to be pulled under a hydrogen partial pressure of less than 3 mbar. However, *Tamatsuka et al* do disclose a partial hydrogen pressure of about 1/3 that of argon (cf. column 6, lines 50-51), while a partial pressure of argon of about 10 mbar is standard in the art, so as to reduce the overall pressure of non-inert gases and yet have a cleansing flow, thereby reducing the occurrence of crystal defects, as evidenced by *Kuhn-Kuhnenfeldt et al* (cf. column 2, lines 62-65). Motivation for applying the same general range of partial noble gas pressure to the invention taught by *Tamatsuka et al* stems from the same overall inert gas pressure optimization. The inventions are combinable simply by adjusting the partial noble gas pressure, while success in doing so can be reasonably expected in view of the experience over decades with the CZ method.

With regard to claim 5: *Tamatsuka et al* teach the method to comprise subjecting the semiconductor wafer to a heat treatment in an atmosphere containing 75% argon and 25% hydrogen (cf. column 6, lines 47-56), instead of less than 3% as claimed by Applicant. The further limitation of claim 5 is thus not necessarily fulfilled by *Tamatsuka et al*, nor by *Kuhn-Kuhnenfeldt et al*. However, Applicant does not explain why the range for the hydrogen content of the argon-hydrogen atmosphere as defined by claim 5 is *critical* to his invention. Applicant is reminded that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

2. **Claim 4 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Tamatsuka et al and Kuhn-Kuhnenfeldt et al as applied to claim 2, in further view of Kim et al (5,942,032) and Tamatsuka et al (6,299,982) (previously made of record and henceforth denoted by "Tamatsuka2"). As detailed above, claim 1 is unpatentable over Tamatsuka et al in view of Kuhn-Kuhnenfeldt et al, neither of whom, however, necessarily teach the further limitation of claim 4.

However, the use of a heat shield in the context of the Czochralski method for selectively shielding a semiconductor single crystal ingot is widely known in the art; see Kim et al (cf. abstract and claim 1 starting at column 10), which is closely related art, namely: the control of the composition of the silicon crystal grown using the Czochralski method. The purpose of the use of the aforementioned heat shield, namely the selective shielding of the monocrystalline ingot to control the type and number density of agglomerated defects in the crystal structure is fully relevant to the invention taught by Tamatsuka et al that aims at a reduction of the number of pits on the wafer surface (cf. column 1, lines 9-11), and therefore there exists ample motivation to combine the inventions. It is indeed possible to combine the inventions because the addition of a heat shield does not interfere with any of the requirements in the invention taught by Tamatsuka et al. Expectation of success is reasonable in view of the success of the use of heat shields in the context of the Czochralski method as shown by Kim et al.

Furthermore, although neither of the references cited in connexion with claim 2 necessarily teach the further limitation of cooling the silicon crystal from a temperature

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of 1050 to 900 degrees Celsius in less than 120 minutes, Tamatsuka et al in US Patent 6,299,982 B1, henceforth denoted by "Tamatsuka2" teach cooling defined by a range that is close to the one given in Applicant's claim, i.e., from 1150 to 1080, at a rate of 2.3 minutes or more, which falls in the range of Applicant's rate of 1.25 degrees per minute or more. Although the temperature range given by Tamatsuka2 is (slightly) different from Applicant's, Applicant fails to show why his range is critical to the invention. Applicant is reminded that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

3. ***Claim 6 is rejected*** under 35 U.S.C. 103(a) as being unpatentable over Tamatsuka et al and Kuhn-Kuhnenfeldt et al as applied to claim 2 above, and further in view of Tamatsuka et al (6,224,668) (previously made of record). As detailed above, claim 2 is unpatentable over Tamatsuka et al in view of Kuhn-Kuhnenfeldt, who, however, do not necessarily teach subjecting the semiconductor wafer to an oxidation treatment. However, the inclusion of oxygen as a reactant in the atmosphere during heat treatment within the context of the Czochralski method of producing a silicon single crystal wafer with reduced defects is well known in the art as exemplified by Tamatsuka et al (6,224,668) who teach the oxidation of a silicon substrate obtained as a wafer from a silicon ingot produced using the Czochralski method (cf. abstract) for the specific purpose of producing a silicon-on-oxide (SOI) substrate of use in SOI semiconductor technology, thereby not only producing the silicon layer but also the oxide layer and

thus improving the efficiency of the SOI production process. Motivation is efficiency of production; combinability follows from the identically used crystal growth method to which the oxidation process is a mere addendum. Success can be reasonably expected in view of the circumstance that both ingredients in the overall process, i.e., the Czochralski method of crystal formation and the oxidation of a silicon layer, are well tested technologies.

Response to Arguments

Remarks pertaining only to claims 1 and 3 are not relevant to the presently amended application in view of the cancellation of claims 1 and 3.

Applicant's remarks with regard to Tamatsuka et al (6,299,982), still a relevant citation in the present Office Action, are appreciate but do not address whether the actual claim language precludes its citation, because other than the actual cooling rate there is nothing in the claim language that is not covered by the other references that were cited.

Similarly, the question is not whether Kim et al teach the invention, but instead the more limited question whether or not Kim et al teach or fail to teach the limitation for which they are cited, which in this case is the use of a heat shield for composition control, and whether or not the teaching of Kim et al in this regard makes the invention obvious, for which the examiner has given his reasons.

On the other hand, the examiner accepts Applicant's position that Schmidt et al is non-analogous art. The present new rejections under USC 103(a) are therefore non-final.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P Mondt whose telephone number is 703-306-0531. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on 703-308-6601. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

JPM
June 20, 2002



NATHAN J. FLYNN
SUPERVISORY PATENT EXAMINER
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